

CLAIMS:

1. An oscillatory machine comprising a support having a load carrying surface and an opposite surface; an electric motor having an airgap through which lines of magnetic flux extend, and an armature coupled to said support, said armature provided with at least two electrically conductive paths each having at least one current carrying segment disposed in said airgap and substantially perpendicularly intersected by said lines of magnetic flux to produce thrust forces which act to move said armature and thus said support in two dimensions in a plane; and, a bearing support system suspending said armature in said airgap, said bearing support system disposed between said support and said armature.

2. The oscillatory machine of claim 1 wherein, said bearing support system comprises at least three ball roller assemblies, each ball roller assembly comprising a ball roller and a roller support surface on which said ball roller rolls, said roller support surface located in a plane between said support and said armature.

3. The oscillatory machine of claim 2 wherein each roller support surface comprises a planar surface which is substantially parallel to a plane containing said support.

4. The oscillatory machine of claim 2 wherein said roller support surface comprises one or more planar surface portions which lie in planes non-parallel to said plane containing said support.

5. The oscillatory machine of claim 2 wherein each roller support surface comprises a concavely curved surface.

35 6. The oscillatory machine of claim 1 further comprising

a motor body and a restraint system coupled to said support and said motor body restraining twisting motion of said support.

5 7. The oscillatory machine of claim 6 wherein said restraint system comprises a parallelogram arrangement of arms comprising first and second arms pivotally coupled together intermediate their respective lengths, each of said first and second arms having one end resiliently coupled to
10 said motor body.

8. The oscillatory machine of claim 7 wherein said parallelogram arrangement of arms further comprises a third arm pivotally coupled to an opposite end of said first arm, a fourth arm pivotally coupled to an opposite end of said second arm, and a fifth arm pivotally coupled to both said third and fourth arms and rigidly coupled to said support.
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9. The oscillatory machine of claim 8 further comprising a hub extending axially of and attached to said support and said armature.
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10. The oscillatory machine of claim 9 wherein said fifth arm is rigidly attached to said hub.
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11. The oscillatory machine of any one of claims 1-10 further comprising a self centering system which returns said support to a central position relative to said electric motor when said electric motor is not energized.
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12. The oscillatory machine of claim 11 further comprising a hub extending axially of and attached to said support and said armature and wherein said self centering system comprises a rod extending through said hub and resiliently coupled at opposite ends to said support and said motor.
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13. The oscillatory machine according to claim 6 wherein the restraint system comprises a first planar spring coupled to the support and the main body.

5 14. The oscillatory machine according to claim 13 wherein the restraint system further comprises a second planar spring coupled to the first planar spring and the main body.

10 15. The oscillatory machine according to claim 14 further comprising a rod connecting the first planar spring to the second planar spring.

16. The oscillatory machine according to claim 15 wherein the rod extends in an axial direction through the armature.

15 17. The oscillatory machine according to any one of claims 13-16 wherein the first planar spring comprises an endless circumferential strip and a plurality of spokes extending radially inward of the strip and joining each other in a central web.

20 18. The oscillatory machine according to claim 17 wherein the first planar spring further comprises a plurality of arms, each arm extending radially inward of the strip and terminating in a free end, the free end of each arm being attached to the support.

25 19. The oscillatory machine according to any one of claims 14-18 wherein the second planar spring comprises an endless circumferential strip and a plurality of spokes extending radially inward of the strip and joining in a central web.

30 20. The oscillatory machine according to claim 19 wherein the second planar spring further comprises a plurality of lugs extending from the endless circumferential strip of the

- 35 -

second planar spring, the lugs being attached to the main body.

21. The oscillatory machine according to claims 19 or 20
5 wherein the rod is attached to the central webs of the first and second planar springs.